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SUBJECT: CONVERSION OF CEKMECE RESEARCH REACTOR AND RETURN OF SPENT FUEL

REF: STATE 1484

11. Summary: A DOE-State team visited Ankara and Istanbul January 14-17 to meet with officials of the Turkish Atomic Energy Commission (TAEK) and operators of the TR-2 research reactor at the Cekmece Nuclear Research Center. Discussions focused on possible Turkish participation in a combined shipment of high enriched spent fuel from the Eastern Mediterranean in September 2005. TAEK noted its general agreement with the shipment but raised questions about how it would affect the ability of the TR-2 to continue operating without a new supply of fresh LEU fuel. The US team agreed to take the Turkish questions back to Washington for interagency review and technical analysis with the intention of making a detailed proposal before the end of February. If an agreement in principle can be reached by that time Turkish participation in a September shipment can probably be arranged. A summary report of the discussions and activities during the visit is at para. 8 End summary.

12. A DOE-State team visited Ankara and Istanbul January 14-17 to meet with officials of the Turkish Atomic Energy Commission (TAEK) and operators of the TR-2 research reactor at the Cekmece Nuclear Research Center. The purpose of the visit was to discuss possible Turkish participation in a combined shipment of spent nuclear fuel (SNF) to the United States planned for September 2005 and to evaluate the condition of the fuel and the capability of the facility to support such a shipment. The proposed shipment would include SNF from research reactors in Austria, Israel and Greece as well as irradiated fuel containing HEU from TR-2.

13. Charles Messick of DOE Savannah River Site, Allan Krass of State/NP/NE and Emboff Kevin Lyon met with TAEK in Ankara on Friday, January 14, while Michael Dunsmuir and Randall Dunavant of Westinghouse Savannah River visited the small Triga research reactor at Istanbul Technical University (ITU). The latter visit resulted in an understanding that the ITU reactor, which uses only LEU fuel, would not be interested in participating in a spent fuel shipment at this time. The full team, with the addition of Nicholas Jenkins of NAC International, DOE's shipping contractor, visited the TR-2 facility at Cekmece on Monday, January 17.

14. In Ankara, Messick presented an overview of the Foreign Research Reactor (FRR) Spent Nuclear Fuel (SNF) Acceptance Program and the proposal that Turkey participate in the proposed September shipment. It was made clear to TAEK that under the rules of the program Turkey, as an "other than high income economy" would not have to pay either the shipping costs or the DOE management fee for the spent fuel. Messick also emphasized the program requirements that the operators agree to convert the reactor from HEU to LEU fuel and to cease irradiation of all the HEU to be shipped at least 90 days before the scheduled fuel loading.

15. The primary TAEK interlocutors were President Mr. Okay CAKIROGLU, Director Dr. Sevkettin Can and Reactor Department Head Dr. Sinan Taylan. They made clear TAEK's continued and expanding interest in both nuclear power and nuclear research and noted that they not only wanted to resume operation of the TR-2 after seismic upgrading, but that they planned to increase its operating power from 5 to 10 Megawatts and to build a new research reactor at a site near Ankara. The TAEK officials noted their agreement in principle to participating in the shipment but also noted specific requests for consideration that would eliminate any risks to the successful operation of the TR-2. In particular they noted that the reactor could continue to operate for some time on their inventory of partially burned HEU assemblies, and they suggested that a satisfactory way would have to be found to replace the unused HEU with LEU before they could agree to participate. Mr. CAKIROGLU also requested that TAEK be permitted to keep a single unirradiated HEU assembly containing about 280 grams of HEU. The U.S. side agreed to take these requests back to Washington for interagency discussion and also asked TAEK to provide a technically detailed proposal for what it wants to do with the one fresh assembly.

16. At Cekmece on Monday the full team was given a tour of the TR-2 reactor. After the tour Messick, Krass and Lyon continued discussion on contract and policy issues, while the Savannah River and NAC reps examined the condition of the fuel and the transferring and loading capabilities of the

facility. A list of discussion items, agreements and proposed actions is provided in the summary record in para.8.

The most important of these from the policy point of view are the question of consideration for unused HEU. DOE and State will discuss these requests and prepare a detailed proposal for TAEK. Experts from the Reduced Enrichment for Research and Test Reactors Program will be consulted for technical advice and will communicate with Dr. Taylan to clarify the operational requirements that must be satisfied. It was understood by both sides that, in order to achieve a shipment in September, these issues must be resolved by the end of February in order to reach an agreement in principle on Turkish participation. It was also agreed that TAEK, in consultation with the US Embassy, would look into the possibility of shipping the SNF from a port closer to the Mediterranean than Istanbul. This would have the advantage of shortening the ship voyage and could have other efficiency and security advantages as well.

17. Inspection of the fuel found no significant corrosion or damage that might delay or prevent a shipment. The SNF pool water was judged to be of good quality, however there was visual indication that a small amount of algae was present. There did not appear to be any insurmountable problems in transferring the fuel from the reactor pool to shipping casks and getting those casks to an appropriate port for loading on the ship. TAEK understands that it is likely that the ship will already have SNF from other countries on board and that this may require some special licensing and security activities. But they expressed no concern that this could not be handled satisfactorily in the time available.

18. The following is the trip report completed by the Department of Energy representative. This report was shared with TAEK and contains more exact details of the findings and actions needed to be taken prior to the return of the fuel rods.

Turkish Atomic Energy Authority (TAEK)
Cekmece Nuclear Research and Training Center (CNAEM)
Istanbul, Turkey

TR-2
January 14 -17, 2005

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PURPOSE OF THE VISIT

To discuss U. S. nuclear weapons nonproliferation policy and program issues concerning the Foreign Research Reactor (FRR) Spent Nuclear Fuel (SNF) Acceptance Program, to discuss potential implementation of a near-term shipment of SNF from the TR-2 Research Reactor and contractual changes to support these activities, to evaluate the HEU SNF for transportation and future storage at the Savannah River Site, to evaluate the equipment and capabilities of the facility to package and prepare the material for shipment, and to determine shipment needs and requirements. WSRC also conducted a brief review of the TRIGA fuel located at the Nuclear Energy Institute at Istanbul Technical University (ITU).

INTRODUCTION

The Turkish Atomic Energy Commission was founded in 1956 as a first step in the recognition of peaceful uses of nuclear energy in Turkey. The first task of this Commission was the establishment of the ekmece Nuclear Research and Training Center (CNAEM) in 1962 in Istanbul. The first Turkish Research Reactor, TR-1 (1 MW), was also installed and operated in the same year at CNAEM. TR-1 was operated continuously for fifteen years from May 27, 1962 to September 13, 1977. The 32 fuel assemblies from TR-1 were sent to SRS in 1984. The TR-1 reactor was functionally replaced by the 5 MW TR-2 reactor in 1982 to meet the increasing demand for radioisotopes. The TR-1 reactor components still exist at CNAEM.

At the time of this visit, the most recent operation of the TR-2 reactor occurred on January 7, 2005 for approximately 4 hours. The reactor is operated briefly approximately once per week. TAEK has plans to increase power from 5 MW to 10 MW in the future. Currently, 18 HEU fuel assemblies and three LEU fuel assemblies are in the core.

The ITU-TRR is a TRIGA Mark II type reactor. Construction was started in 1975 and initial criticality occurred in 1979.

The reactor operates at 250kW using the original core consisting of 69 stainless-steel-clad LEU rods. In 1999, the reactor had accumulated approximately 231 MWhr of operation. Ten fresh TRIGA rods remain at ITU, two of which are instrumented. Additional information can be found in the previous DOE trip report meeting minutes dated October 13, 1999.

FUEL INVENTORY

The TR-2 fuel assemblies are MTR type assemblies.

Characteristics of TR-2 fuel and control assemblies that may be returned to the U.S. are provided below.

HEU
Nominal Number at Facility
30 Consisting of:
18 standard (23 plates),
1 fresh control instrumented assembly
2 irradiation (12 plates)
1 standard instrumented assembly

8 control (17 plates))

Enrichment 93.3 %
Fuel Meat U-Al alloy
Clad Al
Initial U-235(g) /assembly
281 standard (2 irradiation@146; 1 std instrumented@281; and
1 control instrumented @ 208)
Burn-up 40% average

LEU

Nominal Number at Facility
16 Consisting of:
10 standard (23 plates)
2 irradiation (12 plates)
4 control (17 plates)
Enrichment 19.8%
Fuel Meat U3SI Dispersion in Al
Clad Al
Initial U-235 (g) / assembly
406 standard (300 control, 212 irradiation)
Burnup (see below)

Only two standard LEU assemblies and one irradiation assembly are in the core at present. The standard elements have a burnup of about 7.5% and the irradiation assembly 12.5%.

Note 1: One of the irradiation assemblies is a fresh LEU assembly. The irradiation assemblies have 12 plates (TR2 1004) with tubes in the center for irradiation activities. The assembly construction is slightly different from the standard assembly.

Note 2: TAEK also has approximately 110 pins about 15' high, 1/2' diameter, containing 1% U-235, that were provided by Brookhaven National Laboratory for a pile experiment in the 1960s. TAEK did not request that these be considered for acceptance.

Note 3: The instrumented assemblies are both HEU, one with little burnup and the other unirradiated.

CONDITION OF FUEL

All spent fuel is stored in the large part of the TR-2 pool. Most of the fuel is stored in two baskets located on the floor of the pool. The assemblies in the core are located in the TR-2 side of the pool. The reactor pool is stainless steel lined. All spent fuel is stored in aluminum racks. Fresh fuel is stored in a vault located one floor below the reactor.

An evaluation of fuel was conducted by WSRC. A detailed report from WSRC will be issued under separate report. The reactor pool water is high quality and the fuel appears to be in good condition; however there was visual indication that a small amount of algae was present. Reactor personnel reported that one standard assembly and one control assembly are suspected of leaking during the previous visit in 1999.

FACILITIES RELATED TO PACKAGING

Mr. Nick Jenkins of NAC International conducted a detailed evaluation of the facilities related to packaging for consideration of conducting a future shipment. The overhead bridge crane capacity is 10 metric tons. There is about six meters (20 feet) between the crane hook and the top of the reactor pool. On the bottom level of the reactor building there is a small transfer cask, about 40 centimeters in diameter that was used to remove fuel from the reactor in 1984 and load the fuel into a shipping cask. The transfer cask is in good condition and weighs about 1 ton. Also stored on this level is the water tank that was used to mate with the IU-04 cask that was used to ship the TR-1 fuel to the U.S.

The reactor building access doors are approximately 3 meters wide x 5 meters high and open onto an asphalt paved area. The access doors open into a partial ground level floor of the reactor building that has a floor load of 20 tons. The outside area leading to the reactor access airlock has sufficient working area and is accessed by a 9 meters (30 feet) wide road leading into a turnaround area just outside the reactor access airlock that is 9mX18m (30, x 60,).

A demineralized water supply is available.

POTENTIAL TRANSPORTATION ROUTE FROM THE REACTOR TO THE PORT OF EXPORT

During the previous visit, M. Ozal stated that the best transportation route would be to take the shore road from the facility to the Istanbul Old City and load the truck/cask onto one of the truck/vehicle ferries departing from the

piers at the base of the Galata Bridge. The ferry would then proceed across the Bosphorus to Harem where the truck would drive off the ferry and travel a short distance to the general cargo piers located there. Another suggestion was made to consider a route to the same port in Istanbul that travels over the "Fatih Bridge" across the Bosphorus along a more convenient road. However, further considerations for a port would be to move the casks further south toward the Mediterranean Sea for greater shipment efficiency.

REGULATORY AUTHORITY

The TR-2 at the Cekmece Nuclear Research and Training Center is part of the Turkish Atomic Energy Authority. There is no separate nuclear regulatory authority in Turkey at the present time.

POTENTIAL PROBLEM AREAS

No significant problems have been identified.

DISCUSSIONS, AGREEMENTS, AND ACTIONS

1.) The following documents were provided to the reactor operator:

- Compilation of Contract Clauses for Countries with Other Than High Income Economies
- Revision 8 of Appendix A
- Revision 9 of Appendix B
- The FRR SNF Acceptance Program Record of Decision with Changes No. 1 through 3 and Fee Policy notices for high income economy countries and other-than-high income economy country reactor operators.

2.) Previous discussions, agreements, and actions were documented in the DOE Trip Report from October 12, 1999.

3.) TAEK understands that DOE desires to establish a shipment of FRR SNF from the eastern Mediterranean area to arrive in the United States in September 2005. TAEK and DOE agreed that a shipment may be possible if an agreement in principal can be reached, particularly regarding an agreement for consideration for TAEK's unused U-235 in the existing HEU fuel. TAEK expects to deplete the HEU, if continued to be used, to 60% burnup. DOE agreed to reply to TAEK regarding U-235 consideration in TAEK's HEU fuel. Additionally, TAEK desires to receive any potential replacement fuel prior to the shipment of their HEU.

4.) TAEK and DOE discussed that a contract between another FRR in Europe and CERCA is being made to fabricate fuel essentially identical to the LEU fuel that would be needed by TAEK, and that a fresh LEU material shipment to CERCA from DOE's Y-12 facility is expected in about two months.

5.) TAEK has been informed that if TR-2 were to make a shipment of fuel to the United States, TAEK would be treated for contractual purposes according to the economic status of the country at the time of the shipment in accordance with the Federal Register Notice for Fee Policy.

6.) The DOE and TAEK also understand that TAEK will be expected to provide assistance to the shipment effort to the extent possible given their technical capabilities at the time of the shipment. Additionally, DOE and TR-2 understand that specific responsibilities for tasks will be negotiated within the contract.

7.) TAEK indicated that there was a desire to restart the reactor for short periods with fuel identified for return shipment. DOE and TAEK will negotiate further reactor operation with fuel that will be returned to ensure sufficient cooling time will exist to meet shipping requirements.

8.) TAEK has been informed that the shipment of SNF from TR-2 may be combined with other countries, shipments and as such it is possible that when the vessel arrives in Turkey's port of export, it could have SNF from other countries on board.

9.) TAEK understands that the DOE FRR SNF Acceptance Program has been extended for 10 additional years and as such, after full conversion to LEU fuel, LEU fuel assemblies with uranium enriched in the United States would be eligible for return to the United States under the FRR SNF Acceptance Program if the fuel is removed from the core (no longer irradiated) prior to May 13, 2016 and the shipment completed prior to May 13, 2019.

10.) Mr. Okay CAKIROGLU requested to keep the one fresh HEU fuel assembly with an agreement that TAEK would not use the assembly if an agreement to participate is made. DOE asked that TAEK submit a request with appropriate justification and conditions

11.) TAEK and DOE agreed that Dr. TAYLAN and Dr. Jim Matos of Argonne National Laboratory will communicate regarding the potential uses of the unused U-235 remaining in TAEK,s HEU fuel.

12.) TAEK,s existing LEU fuel was manufactured by CERCA. Specifications are contained in CERCA drawing 2588200 dated April 12, 1991 for the control assemblies and CERCA drawing 2588100 dated April 4, 1991 for the standard assemblies.

13.) TAEK and DOE understand that TAEK currently has uranium credit at DOE,s Y-12 Facility. According to Y-12 the credit is for 4.703 Kg at 85.6%, which translates to approximately 21 Kgs of LEU at 19.75% enrichment. Exact amounts must be verified.

14.) Mr. Kevin Lyon of the US Embassy in Ankara agreed to investigate the potential use of other ports in Turkey that may make a shipment from TR-2 more efficient for a combined shipment.

19. This cable was drafted by State NP/NE, Allan Krass, and cleared by relevant Washington offices.

EDELMAN